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ENFORCEMENT CONFERENCE. MONONGAHELA RIVER AND ITS TRIBUTARIES. MINE DRAINAGE REPORT TO CONFEREES

Environmental Protection Agency
Cincinnati, Ohio

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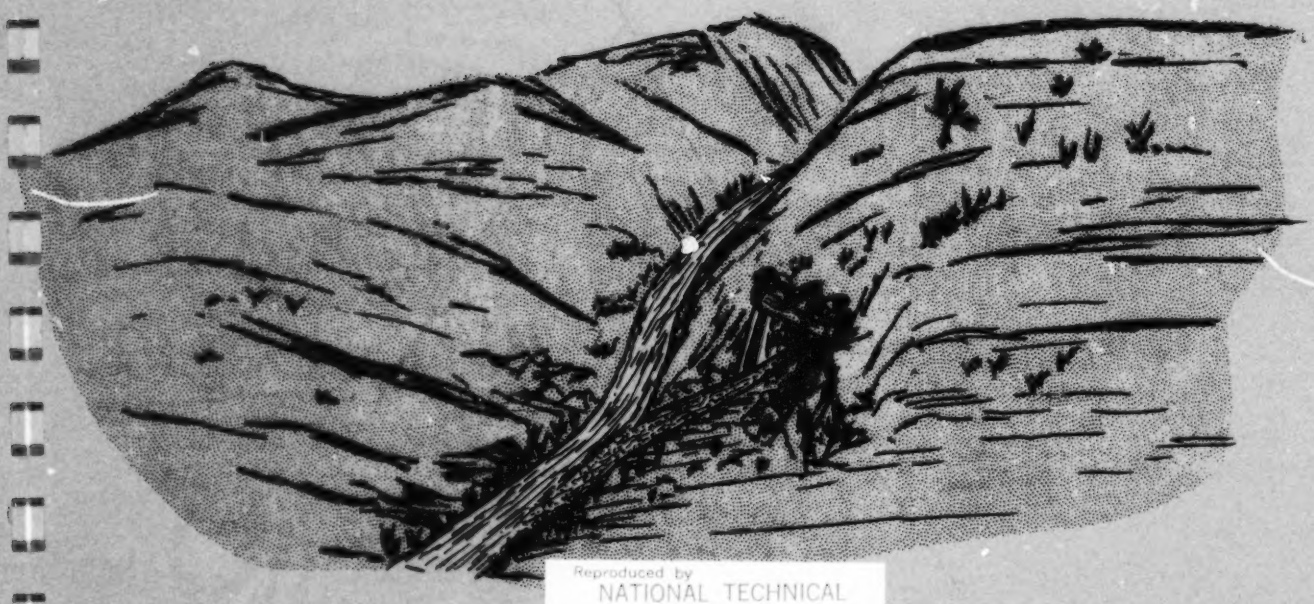
CLEAN WATER

ENFORCEMENT CONFERENCE

MONONGAHELA RIVER & ITS TRIBUTARIES

MINE DRAINAGE REPORT TO CONFEREES



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ENVIRONMENTAL PROTECTION AGENCY

1971

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The Monongahela River, shown in Figure 1, is formed by the confluence of the West Fork and Tygart Valley rivers at Fairmont, West Virginia. The drainage area of the basin is 7,384 square miles with 2,736 square miles in Pennsylvania, 4,228 square miles in northeastern West Virginia and 420 square miles in western Maryland. The river flows in a northerly direction and joins the Allegheny to form the Ohio River at Pittsburgh, Pennsylvania. Major tributary rivers are the Youghiogheny, Cheat, West Fork and Tygart Valley. The Monongahela Basin is mountainous and has rugged topography with narrow stream valleys several hundred feet below the level of the uplands. The river flows through the Appalachian Plateau region.

In the early 1960's, the United States Secretary of Health, Education, and Welfare became increasingly aware that a serious interstate pollution problem was occurring in the Monongahela River Basin. On the basis of reports, surveys, and studies, the Secretary called a conference on August 7, 1963, concerning pollution of the Monongahela River and its tributaries. Discharges of untreated and inadequately treated sewage and industrial waste, including coal

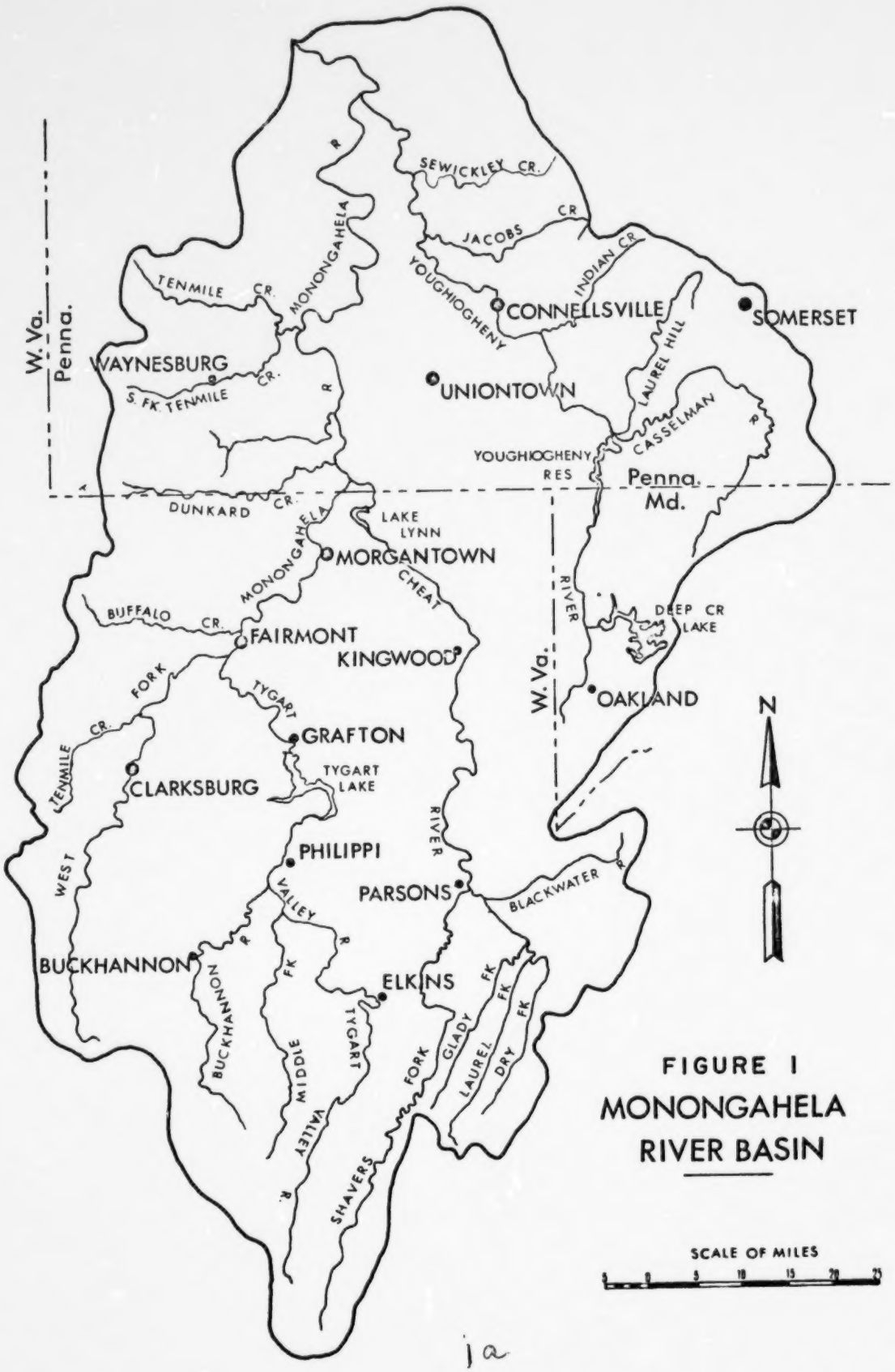

FIGURE 1
MONONGAHELA
RIVER BASIN

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mine discharges in West Virginia, were endangering the health and welfare of persons in Pennsylvania, a state other than that in which the discharges originated.

The conference was held December 17-18, 1963, at Pittsburgh, Pennsylvania. Conferees representing the state water pollution control agencies of Pennsylvania, Maryland, and West Virginia, the Ohio River Valley Water Sanitation Commission, and the Department of Health, Education, and Welfare (DHEW) attended the conference. (The responsibilities of the DHEW were transferred from the U. S. Public Health Service to the Federal Water Pollution Control Administration (FWPCA) in January 1966. The FWPCA was transferred from DHEW to the Department of the Interior in May 1966, subsequently renamed the Federal Water Quality Administration (FWQA), and transferred to the Environmental Protection Agency in December 1970.)

The Chairman of the conference pointed out that:

1. Under the Federal Water Pollution Control Act (33 U. S. C. 466 et seq.) pollution of interstate waters which endangers the health or welfare of persons in a state other than the one in which the discharges originate is subject to abatement under procedures described in Section 8 of the Federal Act.

2. The first step of this procedure is the calling of a conference.

3. The purpose of the conference was to bring the states, the interstate agency, and the Department of Health, Education, and Welfare and other interested parties together to review the existing situation and the progress made, to lay a basis for future action by all parties concerned, and to give the states, localities, and industries an opportunity to take any remedial action which may be indicated under state and local law.

The conferees unanimously agreed on the following conclusions and recommendations:

"1. Pollution of an interstate nature exists in the Monongahela River Basin which adversely affects municipal and industrial water supplies, fish and wildlife, and recreation, such as fishing, boating, swimming, and navigation.

2. The States of West Virginia, Pennsylvania, Maryland, and the Ohio River Valley Water Sanitation Commission have made appreciable progress in water pollution abatement and have presented acceptable programs for the control of industrial and municipal wastes.

3. Cognizance is taken of Pennsylvania's program to abate pollution from such sources by the end of 1966.

Commensurate programs have been developed by West Virginia and Maryland. It is recognized that court action may necessarily modify this program and that economically depressed communities in the basin may have to depend on outside financial assistance.

4. The establishment of a technical committee consisting of representatives of West Virginia, Pennsylvania, Maryland, the Ohio River Valley Water Sanitation Commission, and the Federal Government to explore the means of abating pollution caused by coal mine drainage is recommended. This committee would be charged with determining the amount of pollution from such mines. The committee also would be charged with developing a remedial program, including a cost estimate."

In accordance with recommendation No. 4, the technical committee was established with the recommended representatives.

The technical committee of the Monongahela River Enforcement Conference held its objective to be:

"To determine the sources, types, and amounts of pollution from coal mines in the Monongahela River Basin, means and cost estimates for abating such pollution."

To carry out this objective the committee established the Monongahela River Mine Drainage Remedial Project. The committee

detailed a scope of work for the Monongahela Project to accomplish these objectives. This work included the search of existing state records of mines located during the joint federal-state program of 1935-39. Field maps and aerial photos for the study were procured and methods to describe and sample sources were developed.

The actual work of locating, sampling and describing the sources of mine drainage began in January 1965 and continued through May 1968. This was accompanied by the location of and sampling at stream stations throughout the basin to provide information on the effects of mine drainage on the stream water quality.

The large amount of data and variety of information to be acquired necessitated the use of automatic data processing methods.

Further programs, other than those for the initial data retrieval, were developed to assist in analyzing the data as well as to improve capabilities of storing, up-dating and retrieving data. For purposes of inventory and reporting of results, the total area of the Monongahela Basin was sub-divided into thirty smaller drainage areas. Detailed data, including site location, description, and discharge data were developed for each sub-basin.

During the inventory, which continued from January 1965 through May 1968, a total of 7,002 sites associated with coal mining were located and described. The relative distribution of the types of sites that were inventoried is shown in Table 1.

Table 1

SUMMARY OF TOTAL SITES INVENTORIED
IN THE MONONGAHELA RIVER BASIN

Site Type	Inactive Sites	& of Total	Active Sites	% of Total	Total Sites	% of Total
Preparation Plant	42	0.6	54	0.8	96	1.4
Strip Mines	2,322	33.2	149	2.1	2,471	35.3
Strip & Auger Mines	65	0.9	14	0.2	79	1.1
Drift Mines	3,373	48.2	278	4.0	3,651	52.1
Strip & Drift Mines	450	6.4	32	0.5	482	6.9
Shaft or Slope Mines	170	2.4	33	0.5	203	2.9
Refuse Piles	17	0.2	1	-	18	0.3
Shaft & Strip Mines	1	-	0	-	1	-
Coal Storage Areas	1	-	0	-	1	-
	6,441	91.9	561	8.1	7,002	100.0

Inactive sites constituted 92 percent of the total. Inactive drift mines constitute nearly one-half of the sites and inactive strip mines account for about one-third of the sites.

Of the 7,002 mine and mine-associated sites, 3,046 were draining at the time of the inventory. Table 2 contains data on the draining sites. The total net acid load from all coal mining sites in the Monongahela River Basin was 1,079,575 lb/day, and the total iron load was 302,896 lb/day. This data does not reflect the additional pollution of other chemicals or sediment which are found in mine drainage.

The data of Tables 1 and 2 are combined and presented as percentages of total in Table 3. The following items are of particular significance in Table 3:

1. The most potent source of mine drainage pollution was active mines. Active sites comprised only 8 percent of all sites and 10 percent of the draining sites, but even with the treatment plants existing at the time of inventory, the active sites contributed 35 percent of the total net acid load and 40 percent of the total iron load in the basin.
2. Underground mines are the source of most acid mine drainage. Underground sites, both active and inactive,

Table 2

SUMMARY OF DRAINING SITES
IN THE
MONONGAHELA RIVER BASIN

SITE TYPE	NO. OF SITES	TOTAL NET ACIDITY (lbs/day)	TOTAL IRON (lbs/day)
Preparation Plants (active)	33	9,541	2,912
Preparation Plants (inactive)	5	1,044	113
Shaft or Slope Mines (active)	21	73,645	43,023
Shaft or Slope Mines (inactive)	24	33,910	27,622
Strip Mines (active)	53	14,428	3,911
Strip Mines (inactive)	738	92,012	15,043
Drift Mines (active)	164	224,076	62,367
Drift Mines (inactive)	1,655	436,049	114,384
Strip & Drift Comb. Mines (active)	26	56,549	7,973
Strip & Drift Comb. Mines (inactive)	263	120,565	20,807
Strip & Auger Mines (active)	8	1,444	1,275

Table 2 (Cont.)

SUMMARY OF DRAINING SITES
IN THE
MONONGAHELA RIVER BASIN

SITE TYPE	NO. OF SITES	TOTAL NET ACIDITY (lbs/day)	TOTAL IRON (lbs/day)
Strip & Auger Mines (inactive)	47	13,402	2,453
Refuse Areas (active)	1	0	0
Refuse Areas (inactive)	7	2,910	1,013
Shaft & Strip Mines (inactive)	1	0	0
TOTALS	3,046	1,079,575 lbs/day	302,896 lbs/day
Dry Sites	3,956		
TOTAL	7,002		

Table 3

PERCENTILE PRESENTATION OF DATA IN TABLE 1 AND 2

	Underground Mines[1]	Surface Mines[2]	Combination Surface and Underground[3]	Other Sites[4]	Total Percentages
Percent of Total Sites (Table 1)					
Active Sites	4	2	1	1	8
Inactive Sites	51	34	6	1	92
Total	55	36	7	2	100
Percent of Draining Sites (Table 2) Total Sites					
Active Sites	6	2	1	1	10
Inactive Sites	55	26	9	0	90
Total	61	28	10	1	100
Percent of Net Acidity					
Active Sites	27.6	1.4	5.2	0.9	35.1
Inactive Sites	43.5	9.8	11.2	0.4	64.9
Total	71.1	11.2	16.4	1.3	100.0
Percent of Total Iron					
Active Sites	34.8	1.7	2.6	0.9	40.0
Inactive Sites	46.9	5.8	6.9	0.4	60.0
Total	81.7	7.5	9.5	1.3	100.0

1. Includes drift and shaft mines.

2. Includes strip and auger mines.

3. Includes strip and drift combination mines.

4. Includes refuse piles, preparation plants, a coal storage area, and a strip and shaft mine.

comprised 55 percent of all sites, 61 percent of the draining sites, and contributed 71 percent of the net acid load and 82 percent of the iron load.

3. Inactive underground sites contributed 43 percent of the net acid load and 47 percent of the iron load and thus are the largest contributors to stream degradation.

If it is assumed that the drainage from combination underground-surface sites originates primarily in underground mines, then underground mines were responsible for nearly 88 percent of the net acid and 91 percent of the iron entering Monongahela River basin streams. By this assumption, the contribution of inactive underground mines was about 55 percent of the net acid and 54 percent of the iron.

Another approach to locating the problem is to tabulate the relative distribution of pollution sources within the Monongahela River basin. A portion of this tabulation is shown in Table 4. More complete tabulations were too voluminous to fit readily into a table. The following comments are noted as a result of these tabulations:

1. The pollutional contribution from all types of active mines was greatest in the Middle and Upper Monongahela River, Lower West Fork River, Lower Tygart River, Lower Cheat River, Lower Youghiogheny River, and Sewickley

Table 4

MONONGAHELA RIVER BASIN
SUMMARY OF INVENTORY DATA

SUB-BASIN No.	Name	AREA (sq.mi.)	STREAM LENGTH Total (mi.)	STREAM LENGTH Affected (mi.)	NUMBER DRAINING SITES	SITE LOADS lbs/day Net Acid	SITE LOADS lbs/day Iron	ESTIMATED COST
1	Lower Monongahela R.	316	474	173	232	12,400	9,069	$ 974,500 1/
2	Redstone & Dunlap C.	151	226	99	20	21,203	18,352	2,310,500 2/
3	Tenmile C., Pa.	338	507	81	53	- 838	2,094	104,000
4	Middle Monongahela R.	264	396	199	125	50,434	16,428	1,620,250
5	Dunkard C.	234	351	28	30	10,994	4,506	742,000
6	Upper Monongahela R.	293	440	180	195	233,453	64,844	2,576,500
7	Buffalo & Paw Paw C.	173	260	42	13	12	934	None
8	Lower West Fork R.	250	375	171	402	201,195	48,029	12,368,350
9	Tenmile C., W. Va.	125	188	37	64	8,945	4,185	970,500
10	Elk C.	121	182	96	109	36,086	12,586	1,976,000
11	Upper West Fork R.	386	579	146	224	8,539	2,115	3,910,000
12	Lower Tygart R.	191	287	123	185	65,902	13,477	4,451,500
13	Middle Tygart R.	313	470	140	146	8,061	1,195	1,879,500
14	Buckhannon R.	309	464	64	268	3,229	1,191	4,718,650

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1/ Sum of $44,000 for at-source mine drainage control and $930,500 initial cost for construction of treatment plants. An annual operating cost of $271,700 is estimated for the treatment plants.

2/ Sum of $1,100,000 for at-source mine drainage control and $1,210,500 initial cost for construction of treatment plants. An annual operating cost of $353,500 is estimated for the treatment plants.

(Continued on next page)

Table 4 (Cont.)

MONONGAHELA RIVER BASIN
SUMMARY OF INVENTORY DATA

SUB-BASIN No.	Name	AREA (sq.mi.)	STREAM LENGTH Total (mi.)	STREAM LENGTH Affected (mi.)	NUMBER DRAINING SITES	SITE LOADS lbs/day Net Acid	SITE LOADS lbs/day Iron	ESTIMATED COST
15	Middle Fork R.	151	227	19	67	1,192	113	975,000
16	Upper Tygart R.	347	521	22	41	7,195	353	1,416,000
17	Leading C.	60	90	-	-	-	-	None
18	Lower Cheat R.	170	255	144	145	140,031	26,907	3,071,500
19	Big Sandy C.	208	312	68	42	1,496	160	858,100
20	Upper Cheat R.	330	495	30	100	19,958	5,166	1,447,500
21	Shavers Fork	215	323	42	32	763	73	486,250
22	Blackwater R. Area	499	749	44	53	11,816	1,282	925,000
23	Lower Youghiogheny R.	259	389	106	106	76,019	21,175	2,388,000
24	Sewickley C.	168	252	41	58	90,144	37,496	6,261,500
25	Middle Youghiogheny R.	149	224	68	29	3,185	622	1,074,000
26	Mounts & Indian C.	157	236	28	58	10,076	1,639	499,000
27	Youghiogheny R. West	183	275	30	17	783	162	263,000
28	Laurel Hill C.	125	188	4	12	30	3	185,000
29	Casselman R.	465	698	125	183	55,576	8,512	3,589,000
30	Upper Youghiogheny R.	434	651	60	37	1,692	228	198,500
	TOTALS	7,384	11,084	2,410	3,046	1,079,575	302,896	62,239,600

Creek sub-basins. Discharges from active underground mines were the primary source of stream degradation only in the Upper Monongahela River sub-basin.

2. Water quality in watersheds in the central portion of the Monongahela River basin was degraded by pollutants from both active and inactive mine sources, and water quality in the headwaters areas was degraded principally by pollutants from inactive mine sources.
3. It was generally true that approximately 20 percent of sources in an area contribute 85 percent of the net acid pollution. This becomes apparent upon detailed study of the individual sub-basins. The average amount of net acid contributed per source varied greatly among the sub-basins.

Yet another approach exists to identify problem areas in the basin. Estimates are made of the total lengths of the streams in the basin that were affected by mine drainage. Results of the study reveal that 2,410 miles of streams were affected by mine drainage. An affected stream was considered one that contained mineralization from mine drainage in concentrations noticeably in excess of background levels. Mileage figures are presented in the form of sub-basin totals in Table 5. The mileage determinations are based on field observations, analytical data, and knowledge of mine drainage source locations. In the right-hand column of Table 5

Table 5

MILES OF STREAMS IN THE MONONGAHELA RIVER
SUB-BASINS AFFECTED BY MINE DRAINAGE

Sub-Basin No.	Sub-Basin	Total Miles of Streams*	Miles Affected	Ratio miles affected/ Total miles
1	Lower Monongahela River	474	173	.36
2	Redstone & Dunlap Creeks	226	99	.44
3	Tenmile Creek, Pa.	507	81	.16
4	Middle Monongahela River	396	199	.50
5	Dunkard Creek	351	28	.08
6	Upper Monongahela River	440	180	.41
7	Buffalo & Paw Paw Creeks	260	42	.16
8	Lower West Fork River	375	171	.46
9	Tenmile Creek, W. Va.	188	37	.20
10	Elk Creek	182	96	.53
11	Upper West Fork River	579	146	.25
12	Lower Tygart Valley River	287	123	.43
13	Middle Tygart Valley River	470	140	.30
14	Buckhannon River	464	64	.14
15	Middle Fork River	227	19	.08
16	Upper Tygart Valley River	521	22	.04
17	Leading Creek	90	**	**
18	Lower Cheat River	255	144	.56
19	Big Sandy Creek	312	68	.22
20	Upper Cheat River	495	30	.06
21	Shavers Fork	323	42	.13
22	Blackwater River Area	749	44	.06
23	Lower Youghiogheny River	389	106	.27
24	Sewickley Creek	252	41	.16
25	Middle Youghiogheny River	224	68	.30
26	Mounts and Indian Creeks	236	28	.12
27	Youghiogheny River West	275	30	.11
28	Laurel Hill Creek	188	4	.02
29	Casselman River	698	125	.18
30	Upper Youghiogheny River	651	60	.09
	Totals	11,084	2,410	.22

*Estimated values obtained by multiplying the drainage area by 1.5 miles of streams per square mile.

**No mining in the basin.

are listed the ratio of the stream miles affected by mine drainage in each sub-basin, to the estimated total miles of streams. In this way, a relative factor is assigned for each defined study area to provide a basis of comparison of the pollution problem.

As indicated by the ratios, the Lower Cheat River, Elk Creek, Middle Monongahela River, Lower West Fork River, Lower Tygart River, Redstone and Dunlap creeks, and the Upper Monongahela River sub-basins had more than 40 percent of the streams affected by mine drainage. The Laurel Hill Creek and Upper Tygart Valley River areas were affected only slightly.

This inventory documented the belief that the Monongahela River is more intensely polluted by mine drainage than any other major river in the United States. Degraded conditions were widespread in most of the principal tributary watersheds. Only minor areas of the basin that contain no mined coal beds were free from the pollutional effects of mine drainage.

Specific mine drainage stream pollution problems noted within the Monongahela River basin are: high concentrations of minerals and chemicals as acidity, iron, manganese, sulfate, and hardness; low pH; and turbidity and bottom deposits of chemical precipitates. In addition, siltation caused by runoff from mining activities often caused severe local stream pollution problems.

Mine drainage affects water uses in various ways. To many, the most dramatic effects of mine drainage pollution are in the

destruction of fish and other aquatic life and impairment to stream appearance. Mine drainage pollution affects the use of water for municipal and industrial water supply by increasing the costs for equipment and water treatment. Additional damaging effects of mine drainage are the increase in corrosiveness to boats, dams, and other structures that are in contact with the water.

Generally, alkaline surface water within the basin occurs in small tributaries located in the northwestern and southern extremities of the study area. With this general exception, surface waters of the basin are acidic or marginally acidic as a result of coal mine drainage. Waters of the Monongahela Basin not affected by acid mine drainage are generally only slightly alkaline "or buffered" with limited acid neutralization capacity. Small amounts of acid drainage seriously affect these streams.

It is startling to realize that less than an 18 percent depletion of the original bituminous coal resource has resulted in the vast mine drainage pollution problem that now exists in the Monongahela River Basin.

Various agencies have outlined good mining practices for active mines. ORSANCO Resolution No. 5-60 as amended and the techniques relating to practical application as suggested in "Principles and Guide to Practices in the Control of Acid-Mine Drainage" provide a basis for minimizing the formation of acid

drainage from active mines. The three states in the Monongahela River Basin have the basic laws necessary for the control of drainage from active coal mining operations, both surface and underground. Each of the three states also has surface mine reclamation laws. Pennsylvania and West Virginia have the authority to control the abandonment of underground coal mines, but Maryland does not presently have such authority.

Since the site inventory was started, Pennsylvania has developed an effective program for the control of drainage from active coal mining operations. Contour or terrace backfilling of strip mines has been required since 1963. A remaining area of technical difficulty in Pennsylvania is the control of drainage following the abandonment of underground mines that were opened prior to 1965, since these mines were not subject to the same pre-planning constraints that went into effect during that year. Regulation of mine drainage pollution is also hampered because the mining of other minerals is not subject to the same regulations as are mining operations for coal until the operation develops a polluting discharge. At that time the mining operation becomes subject to the same regulations as the coal mining operation.

West Virginia had the earliest surface mining law of any state (1946) and has a generally effective program for the reclamation of land disturbed by active and inactive or "orphaned" surface mines. The legal authority to control pollution from active deep

mines has existed for some time, but progress has been hindered because of the lack of personnel and funds. As of July 1, 1969, the Division of Water Resources, Department of Natural Resources, was given the authority to control the opening, re-opening, operating, and abandonment of all deep mines, quarries, or preparation plants, but the implementation of this authority will be dependent on financial constraints related to regulatory agency needs.

These data fulfill the difficult charge to the Committee and the Project "to determine the sources, types, and amounts of pollution from coal mines in the Monongahela River basin . . ." The second charge, " . . . to determine cost estimates for abating such pollution. . " was also a difficult task.

Abating pollution from inactive mines is a task the cost and success of which are difficult to accurately predict at this time. The difficulty derives from the fact that there is little experience with watershed-scale abatement projects upon which to base estimates.

Order-of-magnitude cost estimates have been prepared to indicate the potential amount that might be necessary to implement a comprehensive program for abating pollution from inactive mines. An estimate of feasible and economical remedial work in each sub-basin was prepared. These estimations of at-source abatement were totaled for the entire Monongahela River Basin as shown in Table 6. A unit cost was estimated and applied to each type of measure suggested. The total estimated costs in Table 6 were obtained in this manner. In two sub-basins, No. 1 and 2, a total of six lime

Table 6

ESTIMATED ABATEMENT COSTS

ABATEMENT TECHNIQUE	ESTIMATED NUMBER OF UNITS REQUIRED	UNIT COST	TOTAL COST
Surface Mine Reclamation	8,954 acres	$500/acre	4,477,000
Subsidence Reclamation	1,682 acres	$2000/acre	3,364,000
Refuse Pile Reclamation	1,786 acres	$2000/acre	3,572,000
Seals to Underground Mine Openings	3,241 seals	$15,000/each	48,615,000
Diversion Ditch	26,400 ft.	$1.50 ft.	39,600
Reforestation of Strips	155 acres	$200/acre	31,000
Treatment Plants	6 plants 17 tons/day net acid	$125,000/ton/day construction	2,141,000*
		Total Construction Costs =	$62,239,600

* An annual operating cost of $625,200, based upon $100/ton/day, is estimated for the 6 plants. The plants are suggested for sub-basins 1 and 2 only.

neutralization treatment plants placed near mine drainage sources are recommended. An initial construction cost of $2,141,000 and an annual operating cost of $625,000 are projected. To this must be added the costs of engineering design, acquisition of land and mineral rights, the costs of maintaining the constructed facilities, and other miscellaneous costs. There is no way to estimate such costs as acquisition of land and mineral rights at this time. In a comprehensive program, such costs could be great, since areas might be involved that include substantial minable coal reserves. The total of these "at source" costs is approximately $60,000,000.

A major defect in the cost estimate is considered to be the cost for underground mine sealing. This estimate is considered defective because the strip mines in areas of early underground mining created more openings to underground mines than originally existed and left many of these openings covered. Preliminary surveys of the present type are not adequate in such situations. If the assumption were made that all areas would be as complex as ones that have been examined in detail in the Upper West Fork River area and in the Upper Tygart River area, the cost of mine sealing alone could be more than ten times the amount shown in Table 6 or more than $486 million.

To summarize: The initial estimated cost of a comprehensive program for at-source control of acid mine drainage from inactive sites in the Monongahela basin would exceed 60 million and might be greater

than 498 million dollars. Calculations of the data from the Monongahela River basin inventory have shown that many problems exist in arriving at definite pollutional load values. This also has been true in arriving at methods to be used for the control of mine drainage. The total aspect of mine drainage treatment or control is a vastly complicated problem. Definite procedures to be used for loading evaluation, treatment or control methods, and the resultant cost analyses for the partial or complete solution to the problem are not possible, based on the type of information requested and obtained. Experience has indicated that because of mining methods and mine conditions the actual number of openings is often as much as ten times the number visible.

To be completely effective, the program would probably need to be supplemented by treatment. If at-source control of drainage from inactive sources were only 50 percent effective, then treatment plants would be needed. Present data indicate that the initial investment in treatment plants to neutralize net acidity from all inactive sources, exclusive of sub-basins 1 and 2, would be in the order of $21,000,000, and plant annual operating costs would be about $6,132,000. The total estimated cost for the additional water treatment over a 20-year period would be about $144,000,000. The cost of the collection systems to transport mine water to the treatment plants may be from one to 20 times more than the cost of the plants. Total estimated costs for at-source abatement and water treatment range from $218 million to $656 million

for a 20-year period.

It should be reemphasized that these costs are only presented to indicate the order of magnitude of funds required. Meaningful estimates can only be obtained by working with small representative areas on a trial abatement basis to obtain data that are reliable and representative.

RECOMMENDATIONS

The technical committee of the Monongahela River Enforcement Conference has agreed to and submits to the conferees the following recommendations:

1. A Remedial Project committee for the Monongahela River Basin be established to direct and coordinate the abatement programs recommended by the conferees. The committee shall be comprised of representatives of West Virginia, Pennsylvania, Maryland, ORSANCO, and the Federal Government.

2. In the event that funds are made available for application to the abatement of mine drainage in the Monongahela Basin, that appropriate state, interstate, and federal agency delegations of authority be given to respective state, interstate, and federal officials who are members of the Remedial Project committee to enable said officials to commit the allocated funds.

3. The Remedial Project committee be chaired by the federal representative and be charged with, but not limited to, the following responsibilities:
   (a) to develop methods to assign priorities to areas or sub-basins that are to receive abatement measures.

These methods shall be based on sound technical principles consistent with attainment of the established water quality standards;

(b) to establish priorities for areas or sub-basins in accordance with the methods developed;

(c) to have prepared more finite estimates on the cost of selected projects;

(d) to review and evaluate state programs in the basin for abatement of present and future pollution from active mining operations;

(e) to evaluate progress and accomplishments of abatement projects;

(f) to determine financial assistance required by the states to carry out selected abatement projects;

(g) to prepare progress reports for submission to the conferees and the Secretary of the Interior by July 1 of each year.

4. The FWPCA provide the technical staff to assist the Remedial Project committee in accomplishing the assigned responsibilities.

5. A legal study be financed by the FWPCA covering an analysis of legal problems in abatement and control of water pollution from mining and associated functions. Model legislation be developed based on:

(a) a study of patterns of ownership of mineral rights in the Basin.

(b) a study of possible state legislation aimed at determining methods to:

1. obtain right of entry for reclamation work.
2. assure public benefit from reclamation work.

6. The state governments will adopt and enforce a program to: abate present and future pollution from active mining operations; establish and define who will be responsible for preventing pollution from mines that are presently active and will be inactivated in the future, as well as the establishment of this responsibility for all future mines prior to their development; and develop a program for maintenance and operation of abatement facilities and measures.

7. That the sum of $5,000,000 be made available to be used for the purpose of initiating engineering studies to determine specific project costs, and to fund agreed to projects. As finite engineering estimates are completed, funds would then be requested in accordance with state plans and priorities as established by the Remedial Project committee.
These initial projects would indicate the degree of effectiveness and feasibility of basin-wide mine drainage control.

In addition, these projects would provide a means for the Remedial Project committee to refine the rough estimates prepared from the existing inventory.

Recommendations were submitted by each member of the technical committee.

GLOSSARY OF TERMS

at-source control — The application of engineering measures within the immediate environment of a location of mine water formation or discharge to reduce or eliminate the mine drainage pollution capability of that location; exclusive of treatment plants.

mine seal — A structure placed in an underground mine opening to reduce or eliminate discharge waters or the pollutional effect of such discharges. Seals may be water-tight and/or air-tight, and may be placed in man-made or naturally-formed openings.

site — Any area located and numbered during the field inventory. It is always associated with coal mining or processing and may or may not drain from one or more points.

source — A coal mining or related location that produced a measurable discharge at the time of the Monongahela River basin inventory. A source may have one or more discharge points.

ENVIRONMENTAL PROTECTION AGENCY

May 1, 1971

To: Chairman, Monongahela Enforcement Conference

From: Henry P. Stetina, Director
Div. of Interstate Compacts and Uniform State Laws
Office of Enforcement, EPA

Subject: Legal Problems of Coal Mine Reclamation
and Drainage Abatement in Appalachia

This is a description of an investigation currently being undertaken at the University of Maryland School of Law into the legal aspects of environmental problems of coal mining in Appalachia. Scheduled for completion in September 1971, the project is directed by Professors Garrett Power and Everett Goldberg, under a grant from the Federal Water Quality Administration (Henry Stetina, Project Officer). The study concentrates on the laws and problems of four states: Pennsylvania, Maryland, Ohio, and West Virginia. The problems and solutions discussed have a more general application, however.

Although coal mining produces a variety of ecological hazards, the major difficulties with which the project is concerned are acid drainage and the scars, erosion and sedimentation associated with strip mining. Acid drainage results from both deep and surface mining.

These environmental difficulties are associated with both active and abandoned mines. Under existing law states have the power to impose on active miners the duty of abating acid drainage and of performing reclamation work while mining is in progress. Pennsylvania, Maryland, Ohio, and West Virginia all have developed regulations along these lines. The study will explore the efficacy of these regulations. One important question to be considered is the extent to which it is constitutionally permissible to prohibit strip mining or deep mining when circumstances suggest that reclamation or acid abatement will be physically impossible or unlikely.

The more difficult problems have to do with abandoned mines. First is the problem of identifying who can be made financially responsible, and who ought to be made financially responsible, for abatement or reclamation work. The complicated system of mi al ownership and the uncertain nature of land titles in many mi ing areas complicate

this problem. Even if all work is to be done by the government, identifying the surface owner may be important to obtain the necessary easements and rights of access. If the government decides to do the work itself, constitutional problems also are raised. On the one hand, some state constitutions prohibit spending public funds for the direct benefit of private landowners. Although these provisions were adopted to meet abuses of the past, they arguably preclude reclamation activities which raise the value of privately owned land. On the other hand, the government's activity may cut off valuable property rights; for example, where mines with remaining coal reserves are sealed. The conflict between the police power and constitutional requirements of just compensation is nowhere more apparent. Although condemnation is a tool always available to the government, its cost suggests that it will not often be used. Moreover, the possibility of financing condemnation activities by the resale of the condemned land to private individuals after reclamation raises the constitutional question of whether such land is being taken for private rather than public purposes.

It is not the purpose of the study to recommend particular abatement methods, except insofar as their legality or propriety from a non-technological standpoint may be called into question. The project has proceeded on the assumption that regulatory activity will come chiefly at the state level, although the role of interstate and federal agencies is also being taken into account.

In addition to standard methods of legal research, the directors have consulted enforcement officials in the states involved and related interstate and federal agencies. Although few specific conclusions have been reached, it is expected that the study will result in a model statute which may be adapted by states to their particular needs.